

HBPM Indian Guidelines March 2026

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Guidelines On Home Blood Pressure Monitoring In India

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INTRODUCTION

Hypertension is a leading modifiable risk factor for cardiovascular morbidity and mortality in India, contributing significantly to heart failure, stroke, kidney failure, and premature deaths.¹ According to the ICMR-INDIAB study, the national prevalence of hypertension is approximately 35.5%, reflecting a substantial public health burden.² However, effective blood pressure (BP) control remains a major challenge. Systematic review and meta-analyses by Kumar *et al.*³ (19 studies, n=44994) and Koya *et al.*⁴ (51 studies, n=338313) reported a control rate of 15-17.5%. One of the key contributors to poor BP control is inadequate measurement and monitoring, both in clinical and home settings. A key barrier to improving hypertension outcomes is the lack of consistent, accurate BP monitoring—both in healthcare facilities and at home. Traditional office-based measurements, while essential, are limited by their infrequent nature, observer variability, and potential for misclassification, especially in cases of white coat or masked hypertension. In contrast, home blood pressure monitoring (HBPM) has emerged as a practical, effective, and patient-centric solution that enables regular, repeated measurements in the patient's usual environment.⁵

The evolution of blood pressure monitoring has mirrored technological advancements—shifting from mercury sphygmomanometers to automated digital monitors, and now toward wearable or smart devices in some settings. In India, this shift is still ongoing, with automated oscillometric monitors becoming increasingly popular due to ease of use, cost-effectiveness, and better accessibility. HBPM, in particular, supports early diagnosis, guides therapeutic adjustments, and empowers individuals to take an active role in managing their health. HBPM has demonstrated superior predictive ability for cardiovascular outcomes and target organ damage compared to office BP readings. Several international guidelines—including those from the European Society of Cardiology (ESC, 2024),⁶ the HOPE Asia Network (2018),⁷ and the Japanese Society of Hypertension (2019)⁸—recommend HBPM not only for diagnosis and monitoring but also for long-term risk prediction. Importantly, in situations where discrepancies exist between office and home BP readings, HBPM should take diagnostic precedence, ideally confirmed by ambulatory BP monitoring (ABPM) when feasible. While ABPM remains the gold standard for out-of-office BP assessment, it is often limited by cost, availability, and patient discomfort. In such contexts, HBPM serves as a reliable and scalable alternative.⁹ (Refer to Table 1)

HBPM in India

Though HBPM is recommended for hypertension management, its use remains low in India—especially in rural areas—with only 18.1% of participants using it. Most users lacked formal training, relying instead on self-learning methods.¹⁰ Asia HBPM survey (India) 2020 reveals that although a high proportion of Indian physicians (88%) recommend HBPM to individuals with hypertension, actual usage remains low, with only about one-third owning or using a device. Inadequate or inconsistent guidance from physicians and low awareness of diagnostic reference values likely contribute to suboptimal HBPM adoption.¹¹ The HBP measurement rate is 47.5% from GRAND Study.¹² These findings underscore the need for standardized physician education and clear patient instructions to enhance the use of HBPM in routine hypertension management and

cardiovascular disease prevention.

Despite its growing importance, there are no widely adopted national guidelines in India that provide standardized protocols for HBPM. This document seeks to fill that gap by offering clear, evidence-based guidance tailored to the Indian healthcare environment. It outlines recommendations for device selection, measurement technique, frequency of monitoring, interpretation of readings, and patient education. It also addresses practical considerations such as affordability, health literacy, and integration with India's national non-communicable disease control programs. By establishing structured practices for HBPM, this guideline aims to support clinicians, healthcare workers, and patients in achieving better BP control and improving cardiovascular outcomes across India.

Table 1: ABPM vs. HBPM.¹³⁻¹⁵

| Feature | ABPM | HBPM |
|--------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Definition | 24-hour automated BP monitoring during routine daily and nighttime activities | Self-measured BP at home, typically twice daily (morning/evening) over several days |
| Time Coverage | Daytime, nighttime, and 24-hour BP; circadian pattern analysis | Morning and evening; limited or no nighttime data |
| Primary Use | Initial diagnosis, detection of BP variability, nocturnal hypertension, and resistant HTN | Diagnosis, long-term monitoring, medication titration, white coat/masked HTN |
| Detection of Nocturnal Hypertension | Excellent | Limited, unless special devices are used. |
| Assessment of BP Variability | Good for short-term variability | Good for long-term variability |
| Reproducibility | Moderate; can be affected by daily activity, poor sleep | High; fixed conditions and time improve reliability |
| Patient Tolerability | Low; often uncomfortable (sleep disturbance, skin irritation) | High; easy to use, and well-accepted |
| Need for Supervision/Training | Requires healthcare professional supervision | Requires patient education for accurate use |
| Use in Pregnancy | Useful for detecting white coat or masked hypertension during pregnancy | Useful for detecting white coat or masked hypertension during pregnancy |
| Sensitivity and Specificity | High sensitivity and specificity for detecting BP patterns | High specificity (86–94%) but lower sensitivity (47–74%) |
| Practicality and Cost | Higher cost; less accessible | Moderate cost; widely available |
| Feedback and Compliance | Delayed feedback, often via clinic | Immediate feedback, improves adherence and self-management |
| Prognostic Value | Strong predictor of cardiovascular outcomes | Also, a strong predictor, especially morning BP; improves treatment outcomes |
| Best Suited For | Diagnosing white coat, masked, nocturnal hypertension; assessing dipping patterns | Monitoring therapy, detecting white coat/masked hypertension, long-term management |

INDICATIONS FOR HOME BLOOD PRESSURE MONITORING (HBPM)

HBPM plays a critical role in the diagnosis, management, and monitoring of hypertension. The following are the key clinical indications for recommending HBPM

White Coat Hypertension (WCH) & Masked Hypertension (MH)

Individuals with elevated office BP readings, but no signs of hypertension-mediated organ damage (HMOD) or cardiovascular complications may have WCH. HBPM helps confirm whether BP is persistently elevated outside the clinical setting, thereby preventing unnecessary initiation or intensification of antihypertensive therapy.

Individuals with normal office BP who have increased cardiovascular risk or show evidence of HMOD (e.g., left ventricular hypertrophy, microalbuminuria) may have elevated BP outside the clinic. HBPM is useful in detecting such masked hypertension.

Evidence:

- According to the India Heart Study, HBPM reveals a high rate of misclassification with office BP measurements, identifying WCH in nearly 24% and MH in 18% of individuals. Over 40% showed diagnostic disagreement between home and first office readings, and poor consistency was noted even between repeated office visits ($\kappa = 0.37$).¹⁶
- According to the GRAND study, the distribution of blood pressure control status was as follows: 55.9% of participants had well-controlled hypertension, 5.1% had white-coat uncontrolled hypertension, 21.8% had masked uncontrolled hypertension, and 17.2% had sustained uncontrolled hypertension.¹²
- According to Kang *et al.*¹⁷ HBPM is useful in identifying WCH and MH due to its high specificity (86–94%) and strong negative predictive value (80–94%), meaning it can reliably rule out these conditions. However, because of its low sensitivity (47–74%), HBPM may miss some cases, especially MH.
- HBPM is valuable for identifying WCH and MH and assessing cardiovascular risk. In untreated individuals, both WCH and MH detected by HBPM are associated with increased cardiovascular risk. In treated patients, WCH does not increase risk, likely due to treatment based on high office readings. However, MH remains a significant risk in both untreated and treated groups, highlighting the importance of HBPM in detecting unrecognized, undertreated hypertension that may be missed by clinic measurements alone.¹⁸

There is no specific data available on the blood pressure values in India. Based on the recommendations of HOPE-Asia network,^{7,19} and Indian guidelines,²⁰ the diagnostic thresholds for HBPM are provided in Table 2.

Table 2: Diagnostic thresholds for HBPM.

| | |
|-------------------------|---------------------------------------------------|
| Hypertension | >135/85 mmHg |
| White-coat hypertension | Office BP: $\geq 140/90$ mmHg, HBPM: <135/85 mmHg |
| Masked hypertension | Office BP: <140/90 mmHg, HBPM: $\geq 135/85$ mmHg |

Resistant or Highly Variable Office BP

Individuals with fluctuating office BP readings, or those with apparent resistant hypertension (i.e., uncontrolled BP despite the use of three or more antihypertensives, including a diuretic), benefit from HBPM to distinguish between true resistance and white-coat effects or non-adherence.

Evidence

- HBPM is essential for detecting masked uncontrolled resistant hypertension (MUCRH). MUCRH was found to be an independent predictor of adverse outcomes, with significantly increased risk of cardiovascular mortality (HR 4.9; 95% CI: 1.2–19.9; $P = 0.03$) and cerebrovascular events (HR 5.1; 95% CI: 1.5–16.9; $P = 0.01$). HBPM allows early identification of these high-risk individuals, supporting its routine use in intensively treated patients to improve risk stratification and guide treatment adjustments.²¹
- HBPM shows good agreement with ABPM and serves as a useful complementary tool in managing resistant hypertension. HBPM demonstrated high specificity (91%) and positive predictive value (89%) for identifying patients with controlled BP. HBPM can effectively differentiate between true, white-coat, and masked resistant hypertension.²²

Evaluation of Hypertension Diagnosis, Control, and Prognosis

HBPM plays a critical role in the evaluation of hypertension diagnosis, control, and prognosis. By allowing multiple readings under usual daily conditions, HBPM enhances diagnostic accuracy and helps confirm true hypertension. It provides a more accurate representation of an individual's BP profile over time, enabling clinicians to assess whether target values are consistently achieved. HBPM values corresponding to office measurements are given in Table 3.

Table 3: HBPM values corresponding to office measurements.^{23,24}

| Office BP (mmHg) | Home blood pressure (mmHg) | | | 24-hour Ambulatory blood pressure (mmHg) |
|------------------|----------------------------|---------|--------|------------------------------------------|
| | Morning | Evening | Night | |
| 120/80 | 120/80 | 120/80 | 100/65 | 115/75 |
| 130/80 | 130/80 | 130/80 | 110/65 | 125/75 |
| 140/90 | 135/85 | 135/85 | 120/70 | 130/80 |
| 160/100 | 145/90 | 145/90 | 140/85 | 145/90 |

Evidence:

- Satoh *et al.*,²⁵ in a meta-analysis (65 studies, $n=21,053$), found that HBPM combined with telemonitoring or enhanced medical support—particularly when using upper-arm cuff devices—led to significantly greater BP reductions compared to usual care (3.27 mmHg systolic and 1.61 mmHg diastolic (95% CI: 2.40–4.15 / 1.14–2.07 mmHg)).

- HBPM demonstrated higher specificity (82%) and comparable sensitivity (71%) compared to OBPM. Some individuals with normal HBPM still had elevated readings on 24-hour ABPM. HBPM should be considered a useful screening and complementary tool, while ABPM remains essential for confirming the diagnosis.²⁶ Similar results were also seen in a meta-analysis in youth by Cueto *et al.*²⁷ (26 studies, n=1992), with modest sensitivity (0.52-0.64) and good specificity (0.82-0.97).
- A systematic review by Falaiye *et al.*²⁸ (12 studies) found that SBPM was effective in reducing BP across various individual groups, regardless of the presence of hypertension-related comorbidities. However, in cases involving comorbid conditions such as stroke and obesity, SBPM showed significant benefits only when combined with other intensive interventions.
- A systematic review and meta-analysis by Tucker *et al.*²⁹ (36 studies), reported that self-monitoring, along with co-interventions (medication, patient education) reduced BP (-6.1 mm Hg).

Enhancing Patient Education and Awareness

Regular HBPM encourages active individual participation in managing their own health. By routinely tracking their blood pressure, individuals become more aware of the importance of lifestyle changes and medication adherence, reinforcing their commitment to treatment. HBPM also promotes a sense of self-care and responsibility, which is particularly valuable in the context of chronic conditions like hypertension. Additionally, it helps reduce anxiety related to BP fluctuations by demystifying the readings—providing individuals with context and control.

Evidence

- In a large Korean study, SBPM over 3 months led to a notable reduction in BP (from 142/88 to 129/80 mmHg), increased target BP achievement (from 32% to 59%), better medication adherence, and greater patient awareness of BP goals and the importance of monitoring.³⁰
- In a randomized trial, individuals using HBPM showed greater within-group improvements in systolic and diastolic BP and adherence scores compared to baseline.³¹

Close Monitoring in High-Risk Populations

Certain populations require more frequent and individualized blood pressure monitoring due to their heightened risk of complications. In individuals with diabetes mellitus, fluctuations in blood glucose levels can significantly affect blood pressure control; HBPM enables more precise adjustments in therapy to maintain optimal targets.³² For patients with chronic kidney disease (CKD), strict blood pressure control is essential to slow the progression of renal impairment, and home monitoring provides a practical way to track trends and guide treatment.³³ In pregnancy, particularly in conditions such as gestational hypertension or pre-eclampsia, HBPM is valuable for detecting fluctuations in blood pressure between clinic visits, allowing for early intervention and reducing the risk of maternal and fetal complications.³⁴

Evidence

- In individuals with Type 2 diabetes, HBPM demonstrated stronger agreement with 24-hour ABPM than OBPM, with higher correlations for both systolic and diastolic BP. HBPM showed superior accuracy, with 100% sensitivity, 79% specificity, and 90% positive predictive value for detecting hypertension.³⁵
- According to a systematic review by Carey *et al.*³⁶ (18 studies, n=1187), HBPM may lead to clinically meaningful reductions in systolic and diastolic BP in patients with CKD, especially when combined with personalized, high-level support. 88% showed improvements in systolic BP and 73% in diastolic BP, with better BP control achieved in 86% of cases.
- According to Ye *et al.*³⁷ HBPM users were significantly more likely to adhere to antihypertensive medications, exercise regularly, and follow dietary sodium restrictions compared to non-users in individuals with CKD.
- David *et al.*³⁸ in a prospective study evaluated BP monitoring methods in renal transplant patients and found that HBPM is a useful adjunct to OBPM and ABPM. While OBPM tended to overestimate both systolic and diastolic BP compared to ABPM, HBPM provided more accurate readings, especially in assessing whether patients had achieved target BP control. At 6 months post-transplant, OBPM was more specific for diagnosing hypertension, but HBPM was more reliable in identifying controlled BP.
- According to Maribashetti *et al.*³⁹ in a prospective observational study, HBPM is a reliable and accurate alternative to ABPM for detecting hypertension in individuals with CKD on hemodialysis. HBPM (143.6/82.69 mmHg) is closely correlated with ABPM readings (mean awake, asleep, and average systolic BP and diastolic BP: 141.69/81.33, 139.39/80.04, and 141.23/80.67 mmHg), demonstrating strong agreement in both systolic and diastolic measurements.
- HBPM appears to be a safe and effective approach for managing hypertensive disorders of pregnancy (HDP). A systematic review and meta-analysis by Kalafat *et al.*⁴⁰ reported that HBPM during the antenatal period was associated with a reduced risk of labor induction, prenatal hospital admissions, and preeclampsia diagnosis. It also resulted in fewer antenatal visits without increasing maternal or neonatal complications.
- According to a randomized trial, 87% of women showed high adherence to HBPM and antenatal follow-ups. Outcomes were comparable to standard care, with similar rates of preeclampsia and complications, but the hospital's stay was significantly shorter in the HBPM group. This study highlights that adherence to HBPM is key to optimizing outcomes in HDP.⁴¹
- HBPM is both feasible and acceptable among postpartum women with a history of hypertensive pregnancies. With proper training, the majority of women and their family members could effectively use HBPM devices, enhancing early detection and management of future hypertension-related complications.⁴²
- A systematic review by Yeh *et al.*⁴³ (6 studies) reported that HBPM, during pregnancy, is feasible, acceptable, and generally produces maternal and neonatal outcomes comparable to clinic-based monitoring.

- A systematic review and meta-analysis by Albadrani *et al.*⁴⁴ (15 studies, n=5335) found that HBPM was superior in reducing the risk of labor induction, postpartum readmissions, and improving birth weight, while showing comparable safety and effectiveness to clinic monitoring in other maternal and neonatal outcomes.

Cardiovascular Risk Reduction

HBPM is a valuable tool in reducing cardiovascular risk by facilitating early identification, consistent management, and individualized treatment of hypertension, a key modifiable contributor to cardiovascular disease. It has been shown to offer superior prognostic insight compared to office-based measurements, serving as a strong indicator of target organ damage and the likelihood of cardiovascular and stroke-related complications.⁴⁵

Evidence

- A study from the J-HOP cohort showed that maintaining a home systolic BP below 125 mmHg was associated with a significantly lower risk of stroke and a trend toward reduced overall cardiovascular events over a 10-year period.⁴⁶
- According to Pai *et al.*,⁴⁷ HBPM can be a reliable and cost-effective tool for detecting nocturnal BP patterns and identifying early signs of target organ damage, such as left ventricular hypertrophy (LVH). Night-time HBPM readings showed a significant correlation with left ventricular mass index, indicating its potential utility in assessing cardiovascular risk.
- Mokwatsi *et al.*⁴⁸ reported that HBPM during sleep hours is not only comparable to ABPM for measuring nighttime BP but may also have greater prognostic value. Nocturnal hypertension detected by HBPM was significantly associated with an increased risk of future cardiovascular events—particularly stroke and coronary artery disease— independent on office BP readings.
- Systematic review by Breaux-Shropshire *et al.*⁴⁹ (137 studies) highlights that HBPM, like 24-hour ABPM, is associated with better BP control and improved cardiovascular outcomes, including reduced risk of mortality. While both methods show similar effectiveness in predicting events such as heart attack, stroke, and kidney failure, HBPM is more feasible for routine use and enhances patient engagement in hypertension management.

Integration with Telemedicine and Technology

The integration of telemedicine and digital technologies with HBPM/SBPM has significantly enhanced the management of hypertension, especially in remote and resource-constrained settings.⁵⁰ By linking BP devices with mobile applications, cloud-based platforms, or wearable technology, patients can transmit real-time blood pressure readings to healthcare providers, allowing for timely adjustments in therapy and continuous monitoring. This connected care model also improves medication adherence, patient engagement, and self-efficacy.⁵¹

Evidence

- A network meta-analysis by Grover *et al.*⁵² (24 RCTs) demonstrated that both telemonitoring and HBPM are more effective than usual care in reducing BP in adults with hypertension. Telemonitoring significantly lowered both

systolic and diastolic BP, while HBPM showed a significant reduction in diastolic BP. Although no significant difference was found between telemonitoring and HBPM, both methods appear to enhance BP control, supporting their integration into hypertension management strategies.

- HBPM integrated with smartphone technology significantly improved BP control among patients with uncontrolled or newly diagnosed hypertension. BP control rates in the HBPM group increased from 42% to 67%.⁵³
- Individuals using a network-connected HBPM device combined with video consultations and remote medication delivery achieved better systolic BP control compared to those receiving usual care, with no increase in adverse events. The telemedicine group had lower morning and evening SBP readings and a higher rate of BP control, demonstrating that HBPM combined with digital follow-up is a convenient, effective, and safe alternative to conventional hypertension management.⁵⁴
- A meta-analysis of randomized trials showed significant reductions in systolic (−7.3 mmHg) and diastolic (−2.7 mmHg) BP, and a 10.1% improvement in BP control favoring telemedicine and HBPM.⁵⁵

Assessment of Hypotension and Related Symptoms

HBPM can aid in detecting postural (orthostatic) hypotension, where blood pressure drops significantly upon standing, a condition often seen in the elderly or those with autonomic dysfunction. HBPM is also useful in evaluating postprandial hypotension, a fall in blood pressure after meals, which is particularly common among older adults. Additionally, for patients experiencing symptoms such as dizziness, lightheadedness, syncope, or vertigo, HBPM provides a practical tool to determine whether fluctuations in blood pressure are contributing to these episodes.⁵⁶

Evidence

- HBPM, when extended to include standing measurements, significantly improves the detection of orthostatic hypotension compared to office-based screening. In a study of 505 patients, orthostatic hypotension was identified in 37.5% using HBPM versus 15% during office visits.⁵⁷
- In a study of 230 hypertensive patients, HBPM revealed a postprandial hypotension (PPH) prevalence of 27.4%. It identified meal-related systolic BP drops (≥ 20 mmHg), which are linked to increased health risks. HBPM also helped associate PPH risk with specific clinical predictors such as older age (≥ 80 years), higher office systolic BP, lower BMI, and prior cerebrovascular disease.⁵⁸ Similar findings were reported by Alfie⁵⁹ HBPM protocols, including pre- and post-meal measurements, detected PPH in 27.4% of individuals, with significantly higher prevalence in uncontrolled hypertensives (42.2%) compared to controlled hypertensives (13.2%).
- HBPM, when used for patient-led postural assessments, offers a reliable, safe, and feasible method to diagnose orthostatic hypotension remotely. In a study involving older adults, 95% diagnostic agreement was observed between patient-conducted and clinician-conducted postural BP measurements.⁶⁰

ADVANTAGES & LIMITATIONS OF HBPM

HBPM has emerged as a valuable tool for the ongoing management of hypertension. It offers several clinical and practical benefits, ranging from improved blood pressure control to enhanced patient engagement and long-term cardiovascular risk reduction. Despite its many benefits, HBPM is not without limitations. Factors such as device accuracy, user error, and lack of nighttime measurements can affect its reliability, underscoring the need for proper guidance and cautious interpretation.^{14,61,62}

HBPM PROCEEDURE

HBPM involves measuring BP in a patient’s home environment using a validated, automated upper-arm cuff device. The standard procedure typically includes taking measurements twice daily—once in the morning, within one hour of waking, and once in the evening—each time after resting quietly for at least five minutes, with the arm supported at heart level. Patients are advised to avoid caffeine, exercise, and smoking 30 minutes prior to measurement.^{19,63} For accuracy, two to three consecutive readings should be taken during each session, spaced one minute apart. This process is usually repeated over a period of 3 to 7⁶⁴ (preferred) consecutive days, and the average of all readings (excluding those on the first day, if instructed) is used for clinical decision-making.⁶² Recording results in a logbook or digital device, along with the date and time, is essential to ensure proper interpretation and follow-up by healthcare professionals. (Refer to Figure 1)

Evidence

- According to Ohkubo *et al.*⁶⁶ (Ohasama study), HBPM is a valuable tool for predicting stroke risk, with its predictive power increasing with the number of measurements taken. Even a single HBPM reading predicts stroke risk better than conventional clinic blood pressure and averaging more than 14 home readings significantly strengthens this prediction.
- According to Groenland *et al.*⁶⁷ HBPM twice daily for at least 3 consecutive days provides a reliable estimate of average home BP, while a minimum of 4.5 days is needed for an accurate diagnosis of hypertension. Shortening the standard 7-day protocol slightly increases variability but still maintains diagnostic reliability, supporting the feasibility of simplified HBPM protocols in routine practice.
- Bello *et al.*⁶⁸ reported that averaging morning and evening BP readings over at least 3 days provides a dependable estimate of home BP and helps accurately diagnose out-of-clinic hypertension. Fewer days or inconsistent measurement patterns may reduce reliability, reinforcing the value of structured multi-day HBPM protocols in clinical practice.

CONSULTATION WITH THE HEALTHCARE PROVIDER AND FOLLOW-UP

Healthcare providers should carefully review the patient’s BP diary or device memory to assess overall blood pressure control. This includes

Table 4: Advantages and limitations of HBPM.

| ADVANTAGES |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • <i>Enable Frequent Monitoring:</i> Allows multiple blood pressure readings over an extended period, offering a more comprehensive picture of BP trends. • <i>Detects White-Coat and Masked Hypertension:</i> Useful in identifying conditions that are missed with clinic-based readings. • <i>High Patient Acceptability and Tolerability:</i> Well-tolerated by patients, easy to use, and suitable for daily routine use. • <i>Reliable and Reproducible:</i> Provides stable, repeatable measurements under standardized conditions, both short- and long-term. • <i>Better Risk Prediction:</i> More effective than office BP in predicting target organ damage and cardiovascular (CV) events. • <i>Empowers Patients:</i> Increases patient engagement and understanding of their hypertension management. • <i>Telemonitoring integration:</i> Can be integrated with remote monitoring systems for healthcare provider follow-up • <i>Detects Blood Pressure Variability:</i> Useful for identifying long-term fluctuations in BP, which can have clinical significance. • <i>Promotes Awareness and Adherence:</i> Encourages better awareness of hypertension and improves compliance with anti-hypertensive medication. • <i>Cost-Effective:</i> Generally, less expensive than ABPM devices and is feasible for use in low-resource settings. |
| LIMITATIONS |
| <ul style="list-style-type: none"> • <i>Device Inaccuracy:</i> Risk of inaccurate readings with non-validated or poorly calibrated devices; improper cuff placement can also affect results. • <i>May Induce Anxiety:</i> Some individuals may become overly concerned or stressed by frequent monitoring. • <i>Risk of Self-Adjustment of Treatment:</i> Patients may inappropriately alter medication based on isolated readings without medical advice. • <i>Lacks Nocturnal and Office Monitoring:</i> Standard HBPM does not capture nighttime BP, limiting its use for diagnosing nocturnal hypertension or dipping patterns; only a few newer models have this capability. • <i>Inaccuracy in Certain Conditions:</i> May yield unreliable readings in patients with severe arrhythmias. • <i>Selection and Reporting Bias:</i> Patients may selectively record or report only favorable readings, leading to inaccurate data. |

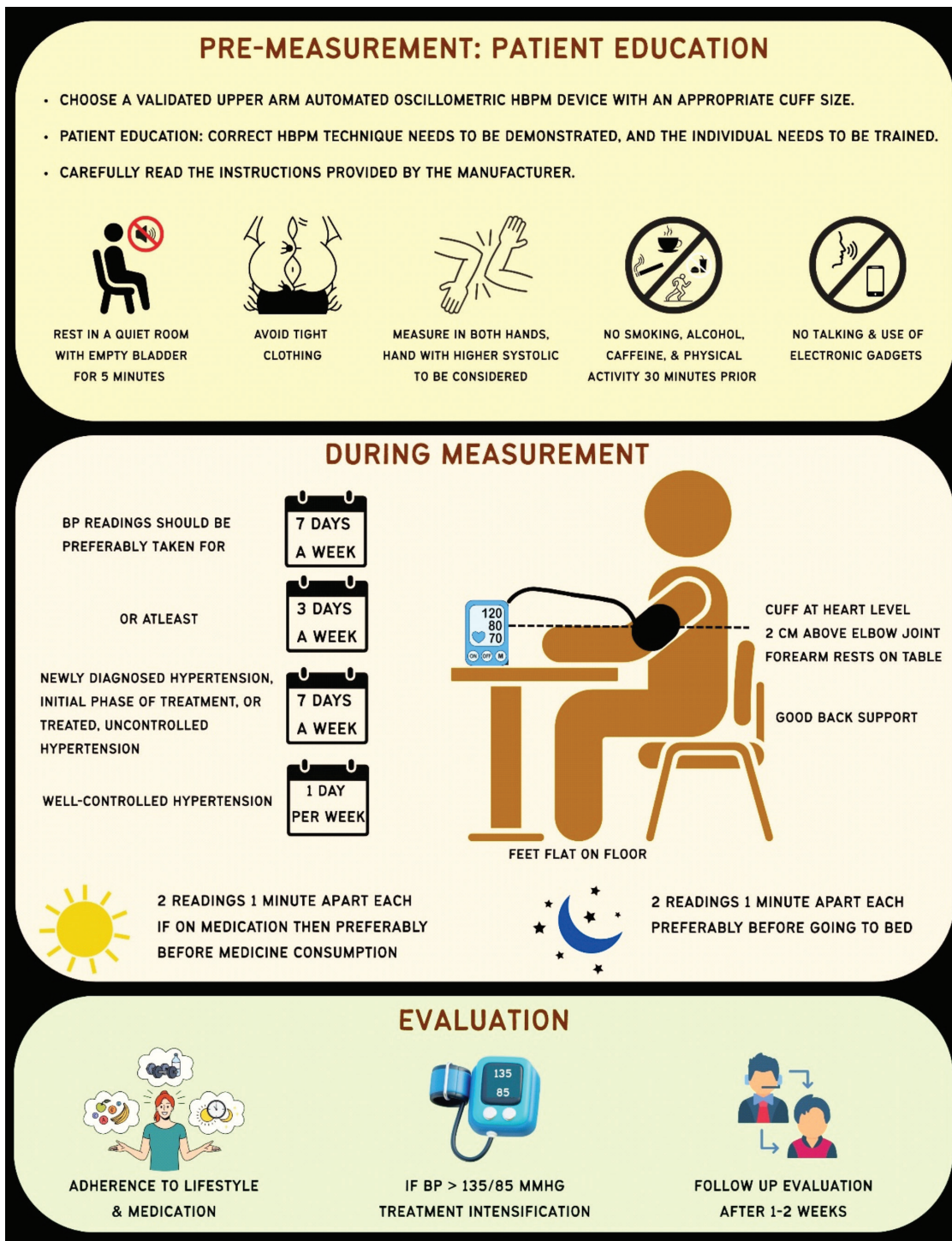


Figure 1: HBPM procedure.^{62,63,65}

evaluating the average home BP values—particularly morning and evening readings—while also noting any variability or abnormal patterns, such as a pronounced morning surge or persistently elevated values. The readings should be interpreted in the context of any reported symptoms, such as dizziness or headaches, to identify potential correlations. Based on this assessment, treatment may be initiated in newly diagnosed patients, adjusted in terms of medication

dose, timing, or drug class, or continued without changes if targets are consistently met. Reinforcement of lifestyle modifications should be emphasized. Where available, home BP readings can be integrated into Electronic Medical Records (EMRs) or digital hypertension registries, ensuring continuity of care and facilitating long-term monitoring and treatment planning.

Patient education

- The follow-up visit also serves as an important opportunity to reinforce proper blood pressure measurement techniques and address any patient concerns.
- During this interaction, the clinician or health worker should reassess key aspects such as cuff placement, body posture, and the timing of measurements to ensure accuracy and consistency.
- It is also essential to clarify any misconceptions the patient may have about their medications or home BP readings. In addition, the visit should include a discussion of lifestyle interventions tailored to the patient’s BP trends—for example, advising on salt reduction, increasing physical activity, and improving sleep hygiene.

Education materials and rural outreach

- Frontline healthcare providers—including pharmacists, nurses, and Accredited Social Health Activists (ASHAs)—play a pivotal role in enhancing the adoption and effectiveness of HBPM across India. In rural and underserved areas, ASHAs and other community health workers are essential for extending the reach of HBPM. Through household visits, they can promote HBPM awareness, assist in recording BP readings, ensure timely follow-up, and help identify high-risk individuals in need of referral to primary care centers.
- To support these efforts, educational materials on HBPM must be culturally sensitive, accessible, and tailored to diverse populations. Materials and device interfaces should be available in major regional languages to enhance comprehension and cultural relevance. For low-literacy populations, the use of local dialects, pictograms, and visual aids can effectively bridge communication gaps and improve health outcomes.
- In areas with limited digital access or literacy, printed resources like illustrated pamphlets, wallet cards, and posters remain essential and can be distributed through health centers, pharmacies, and outreach programs.
- Conversely, in urban and semi-urban populations with greater smartphone penetration, digital tools such as mobile apps, explainer videos, WhatsApp infographics, and SMS reminders offer interactive education and real-time engagement, further empowering patients in the self-management of their blood pressure.

DEVICES FOR HBPM

The mercury sphygmomanometer was long considered the gold standard for BP measurement due to its accuracy. However, its use has declined, particularly in community and home settings, due to environmental concerns related to mercury toxicity.⁶⁹ Currently, two main types of non-mercury devices are widely used: oscillometric and aneroid sphygmomanometers. Oscillometric devices are fully automated and electronically control cuff inflation and deflation. These are user-friendly and preferred for both home and clinical settings, especially when validated and properly calibrated. Aneroid sphygmomanometers, on the other hand, are manually operated and require a stethoscope and a standard BP cuff. They serve as a practical alternative in clinical environments where mercury devices are no

longer available but require user training to ensure accuracy.⁷⁰

For home and office BP monitoring, automated upper-arm oscillometric devices are recommended, provided they are validated for accuracy and maintained with regular calibration—ideally once every 12 months.⁵⁶ A universal validation standard, known as the AAMI/ESH/ISO protocol, has been jointly established by the Association for the Advancement of Medical Instrumentation (AAMI), the European Society of Hypertension (ESH), and the International Organization for Standardization (ISO).^{71,72}

Lists of validated BP monitors are publicly available through reputable sources such as:

- U.S. Blood Pressure Validated Device Listing (<https://www.validatebp.org>)
- The Dabl Educational Trust (http://www.dableducational.org/sphygmomanometers/devices_2_sbpm.html#ArmTable)
- STRIDE BP (www.stridebp.org)

Finger and wrist BP monitors are generally not recommended due to inaccuracy caused by factors like peripheral vasoconstriction, distance from the heart, and limb positioning. Incomplete compression of the radial artery can also distort readings. However, wrist devices may be used cautiously in obese and elderly individuals with limited mobility, provided they are properly positioned and validated.⁶¹

To select the appropriate cuff size, the patient’s upper arm circumference should be measured at its midpoint. The cuff’s bladder should have a length that covers 80–100% of the arm’s circumference and a width that is approximately 40% of that measurement.²⁰ (Table 5)

Table 5: Standard cuff size based on ACC/AHA.⁷³

| Classification | Upper arm circumference (cm) | Bladder dimension (width x length, cm) |
|-------------------|------------------------------|----------------------------------------|
| Small adult | 22-26 | 12 x 22 |
| Adult | 27-34 | 16 x 30 |
| Large adult | 35-44 | 16 x 36 |
| Extra-large adult | 45-52 | 16 x 42 |

| Recommendations |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1) HBPM is recommended for diagnosis, treatment monitoring, and long-term management of hypertension in adults. |
| 2) HBPM is indicated in: <ul style="list-style-type: none"> • Suspected white coat hypertension (elevated office BP, normal HBPM). • Suspected masked hypertension (normal office BP, elevated HBPM). • Resistant or variable office BP, to distinguish true resistance from white-coat effects. • High-risk populations (diabetes, CKD, pregnancy, post-transplant, elderly). • Postural or postprandial hypotension evaluation. |
| 3) Diagnostic thresholds <ul style="list-style-type: none"> • Hypertension: HBPM \geq135/85 mmHg. |

- White coat hypertension: Office BP $\geq 140/90$ mmHg, HBPM $< 135/85$ mmHg.
 - Masked hypertension: Office BP $< 140/90$ mmHg, HBPM $\geq 135/85$ mmHg.
- 4) Use validated, automated upper arm oscillometric devices compliant with AAMI/ESH/ISO standards. Measure twice daily (morning within 1 hour of waking, evening before bedtime). Each session: take 2–3 readings, 1 minute apart, after 5 minutes rest. Perform for at least 3 consecutive days (preferably 7); excluding day 1 readings when calculating averages.
 - 5) HBPM readings take precedence over office BP when discrepancy exists, especially if confirmed by ABPM.
 - 6) Review HBPM data regularly during clinical visits; reinforce correct measurement technique. Train patients for device use, posture, timing, and recording.
 - 7) Educate lifestyle modification, adherence, and interpretation of results. Caution against self-adjustment of medications without clinician input.
 - 8) Encourage linkage of HBPM devices with teleconsultation platforms for remote monitoring.
 - 9) Utilize mobile applications, cloud storage, and SMS alerts for data transmission and feedback.
 - 10) Special populations
 - Diabetes: HBPM is preferred for detecting BP variability and guiding therapy intensification.
 - CKD: Recommended for close monitoring to delay the progression of renal disease.
 - Pregnancy: HBPM is feasible and safe for monitoring hypertensive disorders, with telemonitoring where possible.
 - Elderly: HBPM is useful for detecting postural and post-prandial hypotension.
 - 11) Be cautious of measurement anxiety and selective reporting by patients.

FUTURE DIRECTIONS

As hypertension continues to be a leading cause of morbidity in India, the role of HBPM will expand beyond individual patient management to become a public health strategy. Key future directions include:

- **Integration with Digital Health Platforms:** Linking HBPM with the Ayushman Bharat Digital Mission and telehealth services to enable nationwide remote monitoring, e-prescriptions, and decision support.
- **Validation of India-Specific Devices:** Ensuring availability and affordability of clinically validated BP monitors tailored for Indian populations (e.g., upper-arm monitors with appropriate cuff sizes).
- **AI-Driven Risk Prediction:** Using HBPM data streams in combination with artificial intelligence to predict hypertension-related events and recommend personalized interventions.
- **Government-Led HBPM Programs:** Embedding HBPM into national programs like NPCDCS through community screening

initiatives, portable BP kits for ASHA workers, and subsidized monitors for high-risk patients.

- **Wearable and Continuous Monitoring:** Exploring the use of cuffless, wearable sensors that can offer real-time, continuous BP data, especially in high-risk or remote patients.

CONCLUSION

HBPM represents a transformative approach in the detection, diagnosis, and long-term management of hypertension, particularly in a diverse and resource-sensitive country like India. With rising hypertension prevalence and persistently low control rates, HBPM offers a practical, cost-effective, and empowering tool that can bridge critical gaps in care. It enhances diagnostic accuracy by identifying white-coat and masked hypertension, enables timely treatment adjustments, and supports better cardiovascular risk reduction through sustained patient engagement. HBPM to be successful in India, it must be adapted to the local context—considering challenges such as affordability, literacy, rural access, and health system integration. These guidelines aim to provide standardized, evidence-based recommendations that clinicians, patients, and health workers can follow to ensure accurate measurement, interpretation, and clinical action based on HBPM data.

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